

Lot 7, Range 1, PORTLAND.

Lot 27, Range 12, BUCKINGHAM



Sketch Section across the Stevenson Phosphate Location in the Townships
of Portland and Buckingham: Province of Quebec

E. J. C. Del.

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REPORT
ON THE
STEVENSON
PHOSPHATE LOCATION,
TOWNSHIPS OF PORTLAND AND BUCKINGHAM,
PROVINCE OF QUEBEC.



BY
E. J. CHAPMAN, PH. D. &c.,
*Professor of Mineralogy and Geology in University College, Toronto,
and Consulting Mining Engineer.*



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E. J. C. Del.

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PRELIMINARY REPORT
ON THE
STEVENSON PHOSPHATE LOCATION,
RIVER DU LIÈVRE, PROVINCE OF QUEBEC.

To W. H. STEVENSON, Esq. &c. &c.
RIMOUSKI.

SIR,—Having received your instructions to furnish you with an impartial Report upon the Phosphate property belonging to your Company on the River Du Lièvre, in the Province of Quebec, I visited the spot on the 15th of the present month (June, 1875), and passed several days upon the ground. In consequence, however, of the undeveloped and comparatively unexplored condition of the property, I am not able, in the condensed statement which I have now the honour to present, to enter into more than general details. At the same time, my examination, although necessarily brief, was amply sufficient to prove the occurrence upon the property of a large amount of phosphate of lime in regular veins of more than ordinary width, and of first-class quality as regards composition. The value of the location, therefore, as a mineral property, may be regarded as entirely confirmed.

I. *Site and General Description of the Property*:—The Stevenson Location includes two areas lying respectively on opposite sides of the River Du Lièvre, at a distance of about twelve miles above Buckingham Village, between which, and the site of the property, the navigation is entirely free from rapids or other impediments. The area on the left or north-east bank of the stream comprises 200 acres in Lot 7 of the

1st Range of Portland; and that on the south-west bank consists of 400 acres, comprising Lot 27 in the 12th Range of Buckingham. On each side of the river the ground consists of good arable soil of an average depth of twenty or thirty feet. This rests on a floor of Laurentian strata, composed essentially of micaceous and hornblendic gneiss, associated with beds of feldspathic and pyroxenic rock. These Laurentian strata crop out in places in the river bed, as in the "Little Rapids" just above the property, and at a distance of about the fourth of a mile, or rather less, from each bank, they rise abruptly into bold hills or ridges from 300 to 400 feet above the ordinary level of the river, as shown in the section attached to this Report. It is in these ridges, from their exposed position, that the phosphate discoveries have been made; but the apatite veins cut the strata almost vertically, and thus pass far below the base of the ridges, widening, and becoming more solid as they descend. Finally, on both areas, apart from the cleared river-flats, the ground is thickly wooded. An ample supply of timber for mining and other purposes can thus be obtained upon the property.

2. *Mineral Features*.:—The country rock of the location, as indicated above, consists of Laurentian gneiss, overlaid along the river banks and a short distance inland by an alluvial deposit of clay and sand. The gneissoid rock upon the location presents four clearly marked varieties, although these graduate in places into each other. A large part is composed of ordinary micaceous gneiss: another variety consists of hornblendic gneiss, the hornblende running here and there into the acicular or actynolite form; a third variety is composed simply of crystalline quartz grains and flesh-red cleavable feldspar; and in a fourth variety, the rock is made up almost wholly of pale green or greenish-grey granular pyroxene. This latter variety is especially abundant in certain places. It has been frequently mistaken for apatite or phosphate of lime, to which at first sight, at least to an unpractised eye, it bears a general resemblance. Many of the so-called phosphate discoveries of the Ottawa District, both in Ontario and

Quebec, consist simply of this mineral. It often accompanies the true phosphate, however, as in the veins and beds of Burgess and adjacent townships, and frequently forms in places the preponderating matter of the vein. Its occurrence, therefore, may be regarded to some extent as an indication of the very probable presence of apatite in the vicinity.

All the openings which I examined on the high ridge lying a few hundred feet from the right bank of the river, on the Buckingham portion of the location, (see the section,) consisted of this pyroxenic rock, or of red feldspathic gneiss, but in one excavation the pyroxene showed a few scattered specks of apatite, warranting farther exploration. I am quite satisfied, indeed, that phosphate veins will be found in this ridge and throughout the surrounding area; but at present the entire ground is practically unexplored; and a few shots put in here and there on the more exposed ledges, are all the development that it has undergone. This Buckingham ridge, and the slopes immediately around it, are, moreover, very densely wooded, and also much encumbered by fallen rock and detritus, so that a mere examination of the ground, without systematic exploration, would lead to no definite results.

The same variety of pyroxene occurs also largely on the Portland ridge, (see accompanying section,) lying back from the left bank of the river, where it has evidently been mistaken for apatite in some of the earlier examinations of the property. This portion of the location has likewise remained undeveloped or nearly so; but the ridge here is less thickly wooded, and although much broken up and covered more or less upon its flanks with fallen masses of rock and detrital matter, it shows exposed ledges and surfaces which admit of closer examination. On some of these exposures, veins of undoubted phosphate may be clearly traced. They cut the rock almost vertically, and run in a general S. W. and N. E. direction. Near the upper part of the ridge, they are greatly pinched and broken up into strings or veinlets, offering, indeed, but little more than indications of actual veins; but this is a common condition of occurrence as regards the higher or sur-

face portions of many veins, and it may be safely assumed that all will widen and become solid workable deposits at lower depths. This view is fully borne out by a partial development of one of the veins, occurring on the northern face of the ridge, during my inspection of the ground. Small strings or runners were seen near the summit of the ridge and at two places lower down, one at about 40 feet, and the other about 100 feet, below the summit. Three or four blasts were put into the rock near the lowermost of these indications, and a solid mass of phosphate was soon brought to light. An additional shot shewed this to be a regular vein of upwards of eight feet in width, running vertically, or at a very slight underlie, in a general S. W. direction, with every indication of widening still more on descending below the base of the ridge. This vein contained a few imbedded fragments of rock, but it was quite free from disseminated pyroxene or calcspar. There can be no doubt that a vein of this strength and character will prove permanent. It may not be readily seen on the opposite or southern side of the ridge, because the rock there is much shattered and disturbed, and huge masses are jammed and squeezed together, but on trenching across the direction of its course in the narrow valley on the north side—or along the slope on the south side—it will undoubtedly be struck; and in the latter direction it will be found, I have little doubt, to extend to, and probably traverse, the bed of the river. Just below the "Little Rapids," small pieces of apatite, evidently belonging to a vein, have been taken out of the river bed; and a narrow vein of a few inches in width, apparently forming part of the same deposit, may be seen running across an exposed surface of rock immediately in the rear of Mr. McMillan's house on the Portland side of the river.

Putting these data together, I have no hesitation in expressing my belief that a large amount of phosphate must be contained within these lots; and that a systematic exploration and development of the Portland ridge and adjacent slopes, more especially, would thoroughly establish the fact.

3. *Character and Composition of the Phosphate*:—Until recently the superphosphate of lime, so largely employed in agriculture, was chiefly manufactured from the coprolite beds or deposits of fossilized excrementa found in various sedimentary rocks. These coprolites, however, are being rapidly worked out, and are thus no longer able to meet the increased demand. Recourse has been had consequently to the mineral phosphate or apatite, a substance met with chiefly in metamorphic or crystalline rocks, under three forms of occurrence:—First, in beds or bedded veins running parallel with the associated strata; secondly, in true veins, cutting the strata more or less transversely; and thirdly, in detached crystals or masses imbedded in the bands of crystalline limestone, so commonly interstratified with gneissoid and other metamorphic rocks. Apatite presents also, mineralogically, two more or less distinct varieties. In one, the mineral is essentially a compound of phosphate of lime and fluoride of calcium; and in the other, of phosphate of lime and chloride of calcium. In the first variety, however, a small amount of chloride of calcium, and in the second a small amount of fluoride, is almost invariably present. All the apatite hitherto discovered in Canada consists of Fluo-phosphate. This commonly presents a clear green colour, but it is occasionally dull purplish-red, or both colours are present together. When the substance is warmed in a powdered condition with strong sulphuric acid, the presence of fluorine is manifested by the highly corrosive action of the evolved fumes on glass. The apatite on the Stevenson Location is entirely green in colour, and its specific gravity averages 3.193. A cubic foot, therefore, weighs very nearly 200 lbs.

A sample, taken personally from the large vein on the northern side of the Portland ridge, showed the following composition:—

Phosphate of Lime.....	89.80	
Fluoride of Calcium	6.87	
Chloride of Calcium	0.26	
Foreign matters : {	Carbonate of Lime	0.85
	Sesquioxide of Iron.....	0.34
	Silica	1.77

As this analysis was made on a fairly-selected sample, composed of four or five pieces of apatite taken from different parts of the exposure, the mineral may be regarded practically as a 90 per cent. phosphate. It is also comparatively free from foreign or intermixed matters, and it is entitled, therefore, in every respect, to rank as a first-class material. Its value in the English market, according to present quotations, would probably fluctuate between £6 and £7 sterling per ton of 2,240 lbs.

4. *Proposed Development*:—In developing this property, I would commence operations on the north or north-east face of the Portland ridge, upon the vein already exposed. Leaving the upper part of the vein untouched, I would remove the heap of fallen rock and débris immediately below it at the foot of the ridge, and after driving in upon the vein, I would stope upwards as high as it paid to do so. At the same time, a cross drift or tunnel might be run from a convenient point in the main drift in an east and west direction, so as to cut the other veins occurring in the ridge. As these veins appear to lie only at short distances apart, the amount of dead work would be comparatively unimportant; and by this method the veins would be struck at a fair depth to test their quality, and no vein could possibly escape detection.

At starting, a certain preliminary expenditure would be necessary on the following items: Blacksmith's shop, with small stock of bar-steel for drills, gads, &c.; powder house; boarding house for men; stable for couple of horses; derrick; supply of hammers, picks, spades, barrows, &c.; improvement of road to loading place on river, and one or two other subordinate points. The phosphate might, of course, be run down to the river—or to a creek which enters the latter—by a double tramway with endless chain, but the cost of this appears to be hardly necessary. A single horse and cart could easily take down ten or twelve tons per day.

5. *General Conclusions*:—In the present undeveloped state of the ground, it is not of course possible to give a definite

statement as to the actual amount of phosphate within the limits of the property. But there is undoubtedly a very large amount. Where a broad and well-defined vein of the character of that described above occurs at any place, additional veins will most assuredly be found in its vicinity; and in the present case there is ample evidence of the occurrence of at least two other veins immediately west of that on which the openings were made at the time of my visit. These veins where they show on the broken and disturbed strata of the ridge, are necessarily pinched and split up into narrow strings; and they present, consequently, at first sight, a very deceptive appearance as regards their real strength and quality. If opened upon, however, towards the base of the ridge, they will be found to exhibit, I have no doubt, good workable dimensions. To give an idea of the large amount of phosphate carried by veins of this character, it may be stated that in a vein of eight feet in width—and the vein already opened bids fair to exceed that width very considerably—each length of 100 feet by, say, only ten fathoms or 60 feet in depth, will contain 4,273 British tons of 2,240 lbs., or 4,786 American tons of 2,000 lbs. each. As the substance is comparatively brittle, however, there would be a certain amount of loss in getting it out and subsequent handling—probably not far short, on an average, of one-fifth of the entire weight. Deducting this, the small section of the vein thus referred to would yield 3,418 British tons, worth, at the minimum price of £6 per ton, no less than £20,508 sterling.

The actual cost of laying down the phosphate at Liverpool or Glasgow ought not to exceed ten or eleven dollars per ton. The items would comprise: (1) getting or winning the ore; (2) barrelling or boxing up; (3) hauling to river; (4) conveyance by scow to Buckingham Village; (5) hauling around rapids at Buckingham to loading ground on the Lièvre Basin; (6) river freight to Montreal or Quebec; (7) ocean freight to Liverpool or Glasgow. It would be advisable, I think, to form a depot at the village, to which the phosphate could also be taken by sleigh during the winter months, ready to be shipped

for market on the opening of navigation. It might, of course, be shipped in bulk, but owing to the brittle nature of the material, the barrelling would more than repay itself by saving loss in transport, and by affording greater facility in handling. The barrels ought also to fetch their full value in England, as they could be utilized afterwards for packing the superphosphate. Three ordinary flour-barrels, properly packed, would hold rather more than a ton of the raw material, assuming this to be put up in moderately small lumps and fragments.

In closing this Report, I may again express my conviction that in the Stevenson Location the Company possesses a phosphate property of undoubted value.

I am, Sir,

Your obedient servant,

E. J. CHAPMAN, PH. D., &c.,

*Professor of Mineralogy and Geology in University College, Toronto,
and Consulting Mining Engineer.*

TORONTO, June 28th, 1875.

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